Scientists get set for simulated nuclear inspection

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Some 40 scientists and technicians from around the world will descend on Jordan in November to take part in a simulated on-site inspection of a suspected nuclear test site on the banks of the Dead Sea.

Playing the part of inspectors, the experts will have access to a wide range of sensor technologies to look for signs of whether a nuclear explosion has taken place. At the same time, other role-players representing the state under inspection will try to put them off their scent.

The aim of this elaborate exercise, as science writer Edwin Cartlidge explains in this month's *Physics World*, is to prepare for the on-site inspections foreseen under the Comprehensive Nuclear-Test-Ban Treaty (CTBT). Opened for signature in 1996, this agreement bans all signatory nations from carrying out nuclear tests anywhere on Earth or in space.

The CTBT has been signed by more than 180 nations to date, but to become legally binding all 44 countries that possessed nuclear technology in 1996 must sign it and then ratify it, which typically means that their parliaments must approve it in a vote. However, eight of those countries, including North Korea and the US, have still to do so.

Until the CTBT gets the backing of all the relevant nations, scientists cannot perform the final and crucial part of the verification regime specified in the treaty: on-site inspection, which would be invoked following initial evidence of any nuclear testing provided by a global

network of sensors known as the International Monitoring System (IMS).

In the article, Cartlidge explains in more detail the role that the IMS's 279 facilities currently play in detecting four types of physical phenomena than can provide evidence of a nuclear explosion having taken place.

Data produced by measuring these phenomena – seismic waves, radioactive nuclei, underwater sound waves and infrasonic waves – are continually sent in near real-time to the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) in Vienna, Austria, where they are pieced together and used to look for any suspicious or unnatural events.

"Unfortunately, the evidence from the IMS is not always enough to convince signatories of the CTBT that a nuclear test has taken place. The network did not, for example, detect any radionuclides following a test North Korea carried out in 2009, and it was nearly two months before stations in Japan and Russia picked up radioactive noble gases after [North Korea's] 2013 test," Cartlidge writes.

Once the experts arrive at the roughly 1000 km2 of mountainous desert and scrubland in Jordan, they will have access to almost all of the sensor technologies available to them under the terms of the CTBT, including ultraviolet light to search for vehicle tracks in the dirt, infrared radiation to hunt down the exact point of any possible explosion, and noble-gas detection systems to measure the telltale gases xenon and argon.

"While the treaty remains on hold, CTBTO scientists will continue to refine and test their monitoring techniques, ensuring that they are as ready as they can be should they finally be called upon to investigate what could be the explosion of a real nuclear weapon. "The exercise in Jordan should provide a stern test of that preparedness," Cartlidge concludes.

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